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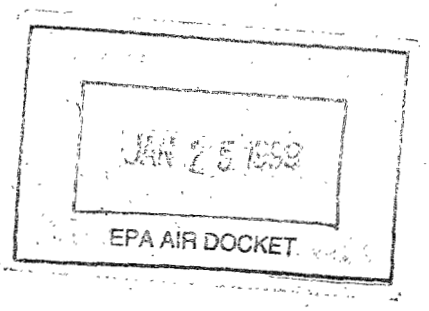
ANALYSIS OF NOx STRATEGIES FOR ELECTRIC POWER GENERATION IN OTAG

Summary Results



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Office of Air and Radiation
U.S. Environmental Protection Agency

ANALYSIS OF NOx STRATEGIES FOR ELECTRIC POWER GENERATION IN OTAG
Summary Results

The U.S. Environmental Protection Agency developed stylized approaches to control NOx emissions to help OTAG consider the implications of different approaches. **None of the options represent an EPA, or OTAG position** on how to best regulate NOx emissions from electric power generation. It is important to recognize that there are other ways that EPA could have designed these options that would lead to different results.

The control options analyzed are:

- **Cap with Trading Only/.20 Emission Rate** - All plant managers collectively face OTAG-wide NOx emission caps and are provided emissions allowances that they can trade. In 2000, the emissions caps for the summer and winter seasons are based on EPA's proposed Title IV rules (see January 19, 1996 notice of proposed rulemaking in the Federal Register). Units are also constrained to meet applicable State NOx emission rate requirements, such as RACT, and Phase I of the Ozone Transport Commission's Memorandum of Understanding. In 2005, a lower OTAG-wide ozone season cap on NOx emissions goes into effect that is based on multiplying the forecasted summer energy use of all fossil-fueled plants in 2000 by .20 pounds per million Btus of energy used.[1] Individual unit allowances could be awarded to facilities in line with their contribution to historical levels of electric generation, or by using other types of allocation processes. Trading for the 2000 cap is on an annual basis. Trading in 2005 at the lower cap level is only for emissions occurring in the summer season. "Banking" (stockpiling of early emission reductions in allowances for later use, or trading) is not allowed.

- **Cap with Trading Only/.15 Emission Rate** - Same as the first option, except the collective summer cap for NOx emissions that begins in 2005 is based on .15 pounds of NOx per million Btus of energy used (instead of .20 pounds).

- **Cap with Trading Only/.25 Emission Rate** - Same as the first option except, the collective summer cap for NOx emissions that begins in 2005 is based on .25 pounds of NOx per million Btus of energy used (instead of .20 pounds).

- **Cap with Trading and Banking/.20 Emission Rate** - The NOx emissions caps are set in a similar way to that of the first option above, but banking of emissions

1 The ozone season or summer season is the months May through September. The winter is the remainder of the year.

is allowable over time. Plant managers can reduce emissions earlier than required and later use, or sell those banked emissions reductions to other units. In this analysis, banked allowances have an infinite lifetime and no discounts or flow controls are imposed.

- **Cap with Trading and Banking/.15 Emission Rate** - Same as the preceding option, except the collective cap for summer NOx emissions in 2005 is based on .15 pounds of NOx per million Btus of energy used (instead of .20 pounds).

- **Cap with Trading and Banking/.25 Emission Rate** - Same as the fourth option, except the collective cap for NOx emissions in 2005 is based on .25 pounds of NOx per million Btus of energy used (instead of .20 pounds).

- **Cap with Trading and Banking/.35 Emission Rate** - Same as the fourth option, except the collective cap for NOx emissions in 2005 is based on .35 pounds of NOx per million Btus of energy used (instead of .20 pounds).

- **Cap with Managed Trading and Banking/.20 Emission Rate** - The NOx emissions caps are set in a similar way to that of the first option above, but banking of emissions is allowable over time. Plant managers can reduce emissions earlier than required and later use, or sell those banked emissions reductions to other units. However, in this managed trading and banking option, there is a 1-for-1 use of "banked" allowances to offset emissions for an amount up to 10 percent of the preceding year's summer NOx cap and a 2-for-1 use of banked allowances for amounts of NOx emissions greater than 10 percent of the preceding year's summer NOx cap. This option is also referred to as "Progressive Flow Control."

- **Cap with Managed Trading and Banking/.15 Emission Rate** - Same as the preceding option, except the collective cap for summer NOx emissions in 2005 is based on .15 pounds of NOx per million Btus of energy used (instead of .20 pounds).

- **Rate-Based Controls/.15 Emission Rate** - In 2000, managers of coal-fired electric generation units comply with the annual emission rate requirements in EPA's proposed Title IV NOx rules and managers of other fossil-fueled units operate in accordance with other existing regulatory standards. In 2005, each generation unit must meet ozone season controls that require individual fossil unit emissions to be at, or below .15 pounds of NOx per million Btus of energy consumed. To simplify the analysis, new units were not required to purchase 1:1 offsets for their emissions from facilities within the OTAG region. (This approach (purchasing emission offsets) has historically been the dominate one for controlling air emissions from stationary sources and would have led to some further reduction of emissions and additional costs.)

Results

EPA estimates of summer season and annual NOx emissions that will occur in OTAG states without any further NOx controls (Base Case) and from implementation of the 10 NOx control options described above are provided in Tables 1 and 2. The annual incremental costs of each approach appear in Table 3. The annual average cost-effectiveness of each option is shown in Table 4.[2] Further details on how EPA conducted this NOx strategies analysis can be found in "Further Analysis of NOx Strategies for Electric Power Generation in OTAG", EPA, September 1996, and the EPA briefing presented at the September 1996 Norfolk OTAG meeting entitled "Preliminary Analysis of Progressive Flow Control."

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2 To estimate the annual average cost-effectiveness for any year for a specific case, the annual costs in that year were divided by the difference in the total annual NOx emissions in the option under examination and the EPA Base Case for the OTAG Region totals (the difference is the annual amount of NOx emissions reductions each option provides from power generation in OTAG states).

Table 1
Estimates of Summer NOx Emissions in OTAG States
Under Alternative NOx Control Strategies
(1000 tons)

APPROACH	2000	2005	2010
Base Case	**2,350**	**2,507**	**2,538**
.15 Trading Only	1,783	653	653
.20 Trading Only	1,783	871	871
.25 Trading Only	1,783	1,088	1,088
.15 Trading/Banking	1,296	975	804
.20 Trading/Banking	1,335	1,164	997
.25 Trading/Banking	1,712	1,541	1,120
.35 Trading/Banking	1,760	1,856	1,526
.15 Managed Trading/Bnkg	1,594	853	718
.20 Managed Trading/Bnkg	1,622	1,071	928
.15 Rate-Based Controls	1,781	680	702

Table 2
Estimates of Annual NOx Emissions in OTAG States
Under Alternative NOx Control Strategies
(1000 tons)

APPROACH	2000	2005	2010
Base Case	**5,385**	**5,782**	**5,865**
.15 Trading Only	4,070	3,071	3,099
.20 Trading Only	4,063	3,326	3,336
.25 Trading Only	4,061	3,544	3,559
.15 Trading/Banking	3,576	3,440	3,263
.20 Trading/Banking	3,616	3,609	3,457
.25 Trading/Banking	3,992	4,003	3,583
.35 Trading/Banking	4,040	4,323	3,991
.15 Managed Trading/Bnkg	3,981	3,313	3,183
.20 Managed Trading/Bnkg	4,106	3,536	3,398
.15 Rate-Based Controls	4,054	3,113	3,206

Table 3
Incremental Annual Costs of Alternative NOx Control Strategies in OTAG
(Billion 1995 $)

APPROACH	2000	2005	2010
.15 Trading Only	($.173)*	$3.076	$3.13
.20 Trading Only	.231	2.128	2.119
.25 Trading Only	.221	1.454	1.475
.15 Trading/Banking	.753	1.851	2.322
.20 Trading/Banking	.701	1.297	1.685
.25 Trading/Banking	.273	.704	1.396
.35 Trading/Banking	.269	.349	.746
.15 Managed Trading/Bnkg	.450	2.373	2.737
.20 Managed Trading/Bnkg	.583	1.718	2.000
.15 Rate-Based Controls	.288	3.498	4.030

*Cost savings result from changes in operating units from Base Case practices in preparation for actions that they will take in 2005 and 2010.

Table 4
Cost-effectiveness of
Alternative NOx Control Strategies in OTAG*
(Dollars per Ton of NOx Reduction)

APPROACH	2005	2010
.15 Trading Only	$1,150	$1,150
.20 Trading Only	850	850
.25 Trading Only	650	650
.15 Trading/Banking	800	900
.20 Trading/Banking	600	700
.25 Trading/Banking	400	600
.35 Trading/Banking	250	400
.15 Managed Trading/Bnkg	950	1,000
.20 Managed Trading/Bnkg	750	800
.15 Rate-Based Controls	1,300	1,500

*All estimates are rounded to nearest $50.